PRIMETALS TECHNOLOGIES

SEQUENCE IMPULSE PROCESS

A STEP TOWARDS CARBON NEUTRALITY FOR BLAST FURNACE IRONMAKING

“The task of every blast furnace operator is to produce pig iron at low costs with a high throughput. With the more stable furnace behavior and the cost savings on reducing agents, the SIP plant makes a significant contribution to this.”

Dr. Dirk Gotthelf
Head of Blast Furnace
Plant Schwelgern
thyssenkrupp Steel Europe

SIP TECHNOLOGY
LOWERING BLAST FURNACE FUEL RATES AND REDUCING OPEX

SEQUENCE IMPULSE PROCESS
PROMOTES GAS FLOW INTO THE FURNACE AND REDUCES OPERATING COSTS

Blast furnace operators face a huge challenge in responding to the ever-more stringent environmental targets and increasing adoption of carbon taxing.

Sequence Impulse Process technology provides a significant step in supporting the transition to a carbon neutral steel production route.

WHAT IS THE SEQUENCE IMPULSE PROCESS?

The Sequence Impulse Process (or SIP for short) was developed by thyssenkrupp AT.PRO tec and has seen success in foundry cupola furnace applications.

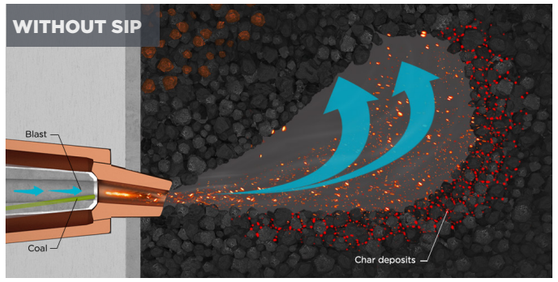
Significant research & development has been undertaken to transfer the technology, culminating in the first full installation on Schwelgern blast furnace 1 at thyssenkrupp Steel Europe's Duisburg plant in Germany.

The full installation has been in operation since December 2020.

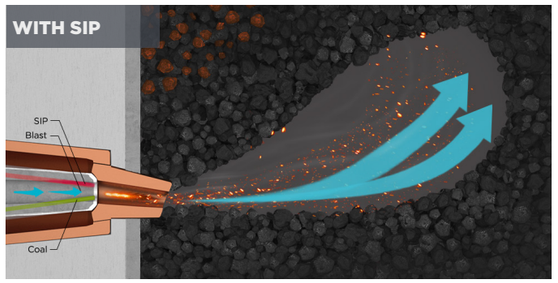
THE TECHNOLOGY PRINCIPLES

Coal injection into the blast furnace results in char materials accumulating, such that penetration of the 'dead-man' of coke is restricted.

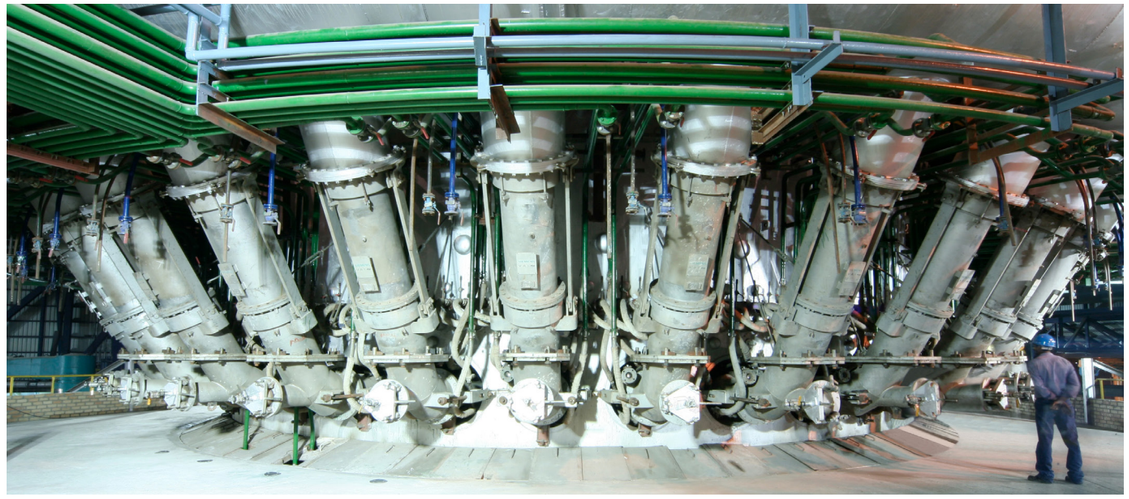
This limits the flow distribution into the center of the furnace and reduces gas utilization.



By pulsing high-pressure oxygen in a pre-determined sequence to each tuyere, shock waves penetrate deep into the raceway of the blast furnace, combusting the fine char and improving coke permeability.



This improves gas utilization and the potential for better furnace drainage.



Blast furnace tuyeres

MAIN BENEFITS

- Reduces fuel rate
- Lowers CO_2 emissions
- Minimizes costs
- Improved across furnace gas distribution and drainage, enhancing production potential
- Increases gas utilization, reducing both the total fuel rate and total CO_2 emissions
- Exchange of coke for higher rates of injected coal results in lower OPEX
- Reduced CO_2 emission taxation costs
- The oxygen previously injected via the stoves or oxy-coal injection is re-purposed
- Offers a rapid Return on Investment (ROI)

FAST RETURN ON INVESTMENT

A typical blast furnace operator can expect the ROI to be in the region of 12 to 18 months, however, in some cases it will be under 12 months.

Our model can provide an indication on the expected ROI for your specific plant based on several variables, including:

- Productivity
- Coke and pulverized coal rate and costs
- Utility costs (O_2 & N_2)

OPERATIONAL ENHANCEMENTS

Once fully operational the benefits of SIP are quickly apparent as experienced at Schwelgern and summarized in the table below

OPERATING DATA

Parameter	Oxy-Coal	SIP Only
Coal [kg/tHM]	169	188
Coke [kg/tHM]	346	318
Fuel rate [kg/tHM]	515	506
CO_2 emitted [kg/tHM]		-36
ηCO	49.4	50.9

> "Through SIP we achieve improved blast furnace operation by improving center permeability and a lower heat load on the shaft."
>
> Dr. Rainer Klock
> Manager Blast Furnace Technology
> thyssenkrupp Steel Europe

“As a supporter and campaigner for the new technology in-house, I am of course very happy that it works reliably and safely. However, I would not have thought that even such “small” amounts of SIP oxygen would have such a strong effect in the blast furnace. In this respect my expectations have been exceeded.”

Dr. Rainer Klock
Manager Blast Furnace Technology
thyssenkrupp Steel Europe

BREAKTHROUGH TECHNOLOGY
REDUCES CO_2 EMISSIONS AND DELIVERS A RAPID ROI

Primetals Technologies Ltd
A Group Company of Mitsubishi Heavy Industries

7 Fudan Way
Stockton-on-Tees, TS17 6ER
United Kingdom

primetals.com

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